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I KOMMISSION HOS C. A. REITZEL
BIANCO LUNOS BOGTRYKKERI
1905

MEDDELELSER FRA KOMMISSIONEN FOR HAVUNDERSØGELSER
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LARVAL EELS

(*LEPTOCEPHALUS BREVIROSTRIS*)

OF

THE ATLANTIC COASTS OF EUROPE

BY

C. G. JOH. PETERSEN

KØBENHAVN
I KOMMISSION HOS C. A. REITZEL
BIANCO LUNOS BOGTRYKKERI
1905

Since Prof. GRASSI more than 10 years ago published his interesting investigations from Sicily on the development of the eel and proved *Leptocephalus brevirostris* to be the larva of *Anguilla vulgaris*, these larvæ have also very often been looked for outside the Mediterranean, but very few have been found up to the present time, and none at all off the Atlantic coasts of Europe, where the grown-up eel is common enough. We cannot count to the larvæ of the common eel the two Leptocephali caught "on the surface of the ocean off New-York" by the American steamer "Albatros" [1]) unless we will identify the American eel with our European form, what we have no suffiscient reason for, at least not at present. C. EIGENMANN and KENNEDY communicate (On the Leptocephalus of the American eel etc. Bull. U. S. F. C. Vol. XXI. p. 84 for 1901 (1902), that the number of vertebræ of the American eel is between 106—110. (Examples: 35 + 71, 35 + 72, 36 + 71, 36 + 73, 36 + 74, 42 + 65) and the two specimens which were found at New York have 40 + 65, 40 + 68, that means about the same number of vertebræ. The number of vertebræ of the European eel is stated by LILLJEBORG to 113 (45 + 68), by GÜNTHER (fide LILLJEBORG) (to 113—117, by KRÖYER to 112–115) (46 + 67), 45 + 67, 45 + 70), it has therefore a somewhat greater number of vertebræ. The investigations are however too few to allow us to draw any definite conclusions. To approach the solving of the question we would also have to count the vertebræ of males as well as of females separately. Provisionally I look upon the American and the European eel as belonging at least to different races [2]).

In "Report for 1898 on the Lancashire Sea-Fisheries Laboratory 1899 p. 17—21" ANDREW SCOTT mentions, that he many times at the coasts of Lancashire, e. g. in Zostera, has found "Leptocephali, identical with the hemilarval stage described by Grassi". Some were kept in aquarium and developed into "young eels" — "no longer transparent". SCOTT describes these "Leptocephali" as follows: "The sizes ranged from $2^{6}/_{10}$ to $2^{9}/_{10}$ inches in extreme length, $^{3}/_{16}$ of an inch in vertical depth, from fin to fin, and about $^{1}/_{12}$ of an inch thick. They were flat, colourless and perfectly transparent, the viscera, and the heart and its movements being easify seen through the skin". According to this description I cannot but see that they in all respects are identical with the thousands of young elvers, that every spring appear also at our coasts, and which we have known for many years.

In the publications of the "Challenger Expedition (Report on the pelagic fishes)" GÜNTHER writes p. 42: "North Atlantic; April 13, 1876; form, Leptocephalus brevirostris" without further details; so it is very scarce. Thus it is after all very little next to nothing, which has been seen of the larvæ of our common eel outside the Mediteranean, still they surely must live near Europe in great numbers. I myself

[1]) C. EIGENMANN: The solution of the eel question p. 13. Trans. American Microsc. Soc. May 1902. vol. XXIII.

[2]) The smallest transformed eels are by GRASSI stated to be of c. 5 cm., I myself hsve seen none from Europe of less than c. 6 cm. In the Zoological Museum of Copenhagen, however, are kept 7 eels caught near Beloxi U. S. A. of which the two smallest only measure 45 mm., the largest 53 mm. They have been preserved in alcohol since 1854; this, however, may hardly be supposed to have diminished their length much. They belong without doubt to the American Anguilla bortoniensis; their number of vertebræ only amounted to 103, 104, 106, 106, 109, 109, 113. For the sake of comparison the vertebræ were counted of 3 eels caught in a rivulet at Ribe (Jütland) in 1899, they measured 60, 62, 62 mm., and the number of vertebræ were 116, 117, 119.

have always thought it absurd to assume a different development for our North-European eel than for the Mediteranean ones. The Leptocephali will surely be found, I thought, if we seek them in the right time, place and manner. As now the "Thor" during its voyage to the Færö Isles and to Iceland in 1904 had to pass deep and warm Atlantic water I charged on purpose JOHS. SCHMIDT in his instructions also to seek the larval eel with the new young-fish trawl. At one of the stations S. W. of the Færö Isles on May 22. of 1904 he at night-time also in the Atlantic found one pelagic *Leptocephalus brevirostris* near the surface. The exact position was 61°21′ N. and 10°59′ W. The larva is a typical Leptocephalus before the transitional stage, ca. 15 mm. in vertical depth and ca. 77 mm. long, with anus as well as the foremost point of the dorsal fin situated far back the centre of the body; larval teeth and larval pectorals are present. Together with this larva another larval eel was caught at the same station, of greater length and of a quite different type; evidently of another genus, of those living their whole live at great depths. Besides these larval eels a few small young *Sebastes*, 2 young ones of *Gadus poutassou*, ca. 20 *Clione limacina*, *Diphyes*, *Physophoridæ* etc. occurred. Rough sea constrained the investigations very much.

As I have written previously in a little pamphlet: "Aalen" (published in the Danish language; Schubothe. Copenhagen.) I took SCHMIDT's find as an evidence for the view, that the larvæ of our North-European eel should be sought outside the North Sea area in the very Atlantic, and I therefore thought, that the larval eel possibly already in this year, 1904, had been caught during the Irish fishery-investigations. These investigations namely are the only one besides the Danish, which in 1904 were extended to the Atlantic, properly so called. For this reason I addressed myself to Dr. E. W. L. HOLT about the subject, and through his great obligingness I became aquainted with the find of another *Leptocephalus brevirostris*, namely a specimen of a length of 73 mm., found "40 miles N. by W. of Eagle Point on Ireland, August 11. 1904". The depth was 735 fms., but no information is offered with regard to the depth in which the larva was caught. It was captured from SS. "Helga". This larva is essentially in accordance with that taken by SCHMIDT. HOLT's counted ca. 116 vertebræ and ca. 265 and ca. 220 finrays, respectively in the dorsal and in the anal-fin. SCHMIDT's counted ca. 114, ca. 265 and ca. 210 respectively. It is a peculiar fact, that these larvæ, which otherwise differ so much from the full-grown eel, already possess all its anal and almost all its dorsal finrays. From what is known about the number of vertebræ (see above) we may already recognize these two specimens as belonging to the European and not to the American form.

I lay much stress on the finds of these two larval eels, not that I ever, since GRASSI in Rome showed me his preparations and transforming stages, doubted the correctness of his view about the development of the eel, but because it so evidently has shown a great want in our entire method of investigation, that we have not been able to find these larvæ outside the Mediterranean; a great want, which however partly is apparent, but also partly real. This want seems partly to be owing to the fact, that these larvæ really do not exist in many more closed waters (Kattegat, North-Sea) and consequently cannot be found there, the apparent want of good methods, partly, that they only exist in open seas, where the water is deep and warm, and where the modern fishing gears as yet have been used very little, but where the eels surely could be found in numbers and in all transforming stages from the egg and onwards; this has not yet happened, and here we have the real want by the investigations. Now we possess in the two mentioned finds a hint, that it is W. and N.W. of Scotland (both finding-places being here) in deep water, that we may cure this want and acquire certainty as to where the European eel breeds. Moreover those finds show, that the larvæ, like the American ones and like the other Leptocephali are pelagic, at least now and then, and not live in the bottom as believed by GRASSI. They will therefore be far easier to catch from a mere technical view, even if we may be prepared to filter much water, it is: to make long hauls. Even a great number of larvæ do not fill much in a bulk of water of a depth of 1000 to 2000 meters.

I have only discussed the question about the propagation of the eel from a quite scientific point of view, I must however also call the attention to the importance of this matter practically seen. The much talking about the propagation of the eel in fresh-water, may now have to cease; all eels immigrate into fresh-water or to closed inshore waters in the sea but emigrate from these to spawn. If they by physical hindrances are prevented from doing so, they must die without spawning. All eels from the Baltic e. g. will gradually, as they grow up, emigrate to the Atlantic, essentially through the Sound (see Report V from the Danish Biol. Station). They must surpass the North-Sea, if they cannot spawn in deep water further north, what I don't suppose, they are able to, as there is too low temperature in the depth. If these eels, when migrating towards the Atlantic, go north or south of Great Britain, is not known, it would not surprise me, if they went through the English Channel. What these migrations of the eel along the coasts, mean for the Swedish, German and Danish fishery is already well-known, but the yield might probably increase further if more rational methods of capture were adopted e. g. by means of light in the water (see my before mentioned pamphlet). If we completely understand the whole great migration-phenomenon of the eel and have found the exact position of the spawning-places, the whole matter will appear in its proper light with regard to Europe, and this view will be of importance for the practical fishery as well as for the principles of legislation with regard to the eel. It is to be hoped, that further information regarding this matter soon will be at hand. The following paper by A. C. JOHANSEN already throws more light upon the habit and the migration in the North Sea of the just metamorphosed *Leptocephalus*, the young elvers.

POSTSCRIPT.

This year, 1905, Dr. JOHS. SCHMIDT has succeeded in finding great quantities of *Leptocephalus brevirostris* in the depths of the Atlantic. Thus we have got an evidence more that the common eel does not spawn in shallow water, neither in the Baltic nor in the North Sea.

600 28/VI 1905

MEDDELELSER FRA KOMMISSIONEN FOR HAVUNDERSØGELSER
SERIE: FISKERI · BIND I · NR. 6 · 1905

REMARKS
ON THE LIFE HISTORY OF THE YOUNG
POSTLARVAL EEL

(*ANGUILLA VULGARIS* TURT.)

BY

A. C. JOHANSEN

KØBENHAVN
I KOMMISSION HOS C. A. REITZEL
BIANCO LUNOS BOGTRYKKERI
1905

During the "Thor"'s spring cruise from March 14th to April 15th of 1905 I have come to an understanding of a feature in the life history of the common eel, which, as far as I know, hitherto has been unknown, namely that the young metamorphosed elvers in the sea are pelagic at night, while they in the day-time keep on the bottom. As soon as this feature was evident to me, we were able to catch these young eels at almost all places in our seas, from Anholt to the Dogger Bank, while they formerly with very few exceptions only were taken in fresh water and in the sea near the shores. The principal data which more particularly throw light upon this matter are as follows:

1) On March 24th of 1904 we caught from the "Thor" 2 elvers of a length of 69 and 71 mm. in the middle of the Kattegat, between Anholt and Læsø, at 56°57′ N. 11°32′ E., and at a depth of 13 meters. They were caught in a pelagic haul in the evening from 8^{55} to 9^{25} o'clock, but the occurrence of these two eels together with a *Gobius minutus* of 28 mm. made me at that time suppose, that the trawl had touched the bottom.
2) In the night between March 17th and 18th of 1905 we made from the "Thor" a pelagic 8 hours' haul with young-fish trawl in Læsø Rende at 57°23′ N. 10°45′ E., and at a depth of 26 meters. In this haul we caught 1 *Anguilla vulgaris* of 72 mm. Though nothing but the presence of this young eel and a few young *Gobius minutus* might suggest it, I still supposed the trawl to have touched the bottom in this haul.
3) In the night between March 22nd and 23rd of 1905 we made from the "Thor" two pelagic 4 hours' hauls with young-fish trawl in the Jammer Bay at 57°20′ N. 9°24′ E. and at a depth of 9 meters. The weather was bright, and we had moonlight. In these two hauls we caught 17 elvers of a length from 64—72 mm. The hauls were made in the surface of the water, and we caught species as *Tomopteris helgolandica, Sagitta bipunctata, Pleurobrachia pileus, Cyanea lamarckii,* together with young *Cottus, Centronotus,* and *Clupea,* without trace of animal life from the bottom. It was here evident to me that the elvers had been caught pelagically in the sea, and it struck me that the two hauls, in which we formerly had taken elvers at considerable distances from the shore, were made at night.
4) On March 24th of 1905 we made a pelagic 4 hours' haul with young-fish trawl in the North Sea off Lodbjerg light-house, at a depth of 17 meters. In the haul which lasted from 2^{45} to 6^{45} a. m. were caught 20 young eels together with quite pelagic forms and *Crangon vulgaris.* In order to try to catch the eel pelagically also by daylight a 4 hours' haul was made at the same place from 7^{10} to 11^{10} a. m., but in this haul was only caught 1 single young eel. We now decided to try to dredge the eels from the bottom, and having attached an iron chain to the ground rope of the young-fish trawl we made a haul in the neigbourhood, where the ground was sandy: off Torup at a depth of 18 meters. In the haul, which lasted from 12^{20}—1^{20} p. m., 36 elvers were caught.
5) The other places where the young eels hitherto have heen taken pelagically at night, are stated below. At several of the stations we have had a skin-buoy attached to the head-line of the young-fish trawl to control, that it did not go to the bottom.

The North Sea.

St. 373. April 9th, 1905. 10 miles N. by W. of Horns Reef light-ship. 55°44′ N. 7°13′ E. Depth 27 meters. In the evening from 8^{40}—10^{40} p. m. in a pelagic haul with young-fish trawl was caught 1 elver of a length of 69 mm.

St. 377. April 13th, 1905. 2 miles W. of Tyborøn 56°41′ N. 8°8′ E. Depth 17 meters. In a pelagic haul with young-fish trawl at night from 0—2 a. m. 6 young eels of a length of 65—76 mm. were caught.

St. 380. April 14th, 1905. Tail End, Dogger Bank, 55°33′ N. 4°39′ E. Depth 32 meters. 1 elver of a length of 65 mm. was caught at night in two pelagic hauls with young-fish trawl of a total duration of 5 hours. A buoy with a 20 meters line was here attached to the head-line.

The Kattegat.

St. 359. March 30th, 1905. 5 miles N. ½ W. of Hirsholmene. Depth 16 meters. In a 2 hours' pelagic haul with young-fish trawl at night were caught 3 elvers of a length of 69—74 mm.

St. 361. April 1st, 1905. Aalborg Bay, 56°48′ N. 10°35′ E. Depth 9 meters. In a 2½ hours' pelagic haul with young-fish trawl from 3^{25}—5^{55} a. m. 3 young eels of a length of 70—75 mm. were caught. In a haul of equal duration made by day-light no eels were caught.

The Belt Sea.

Dr. Petersen informs me that he in April, 1905 has noticed the pelagic habit of the young elvers in the Kerteminde Bay at night.

6) By daylight we have in total only caught 2 single elvers pelagically, though the young-fish trawl has been used more during the day than during the night. On the contrary we have by daylight in several places caught elvers on the bottom at considerable distance from the shore. These places are stated below.

The North Sea.

St. 44. April 14th, 1903. 5 miles S. by E. of Blaavands Point. 55°29′ N. 8°8′ E. Depth 11 meters. In 1 haul of a duration of 15 minutes with young-fish trawl, without iron chain, 1 elver of a length of 71 mm. was caught.

St. 354. March 24th, 1905. 3 miles W. of Torup beacon, 56°58′ N. 8°18′ E. Depth 18 meters. Gear: Young-fish trawl with iron chain on ground rope. In a haul of 1 hour, 36 young eels of a length from 65 to 78 mm. were caught.

St. 381. April 15th, 1905. 8 miles S. S. W. of Blaavands Point, 55°26′ N. 8°2′ E. Depth 14 meters. Gear: Young-fish trawl with iron chain on ground rope. In one half an hours' haul 16 young eels of a length from 68 to 79 mm. were caught,

St. 382. April 15th, 1905. The northern part of Slugen, 55°36′ N. 7°50′ E. Depth 15 meters. Gear: Young-fish trawl without iron chain. In a 15 minutes' haul were caught 3 young eels of a length of 70—76 mm.

The Skagerak.

St. 367. April 7th, 1905. 13·5 miles N. E. by E. of Skagens light-ship, 57°57′ N. 11°0′ E. Depth 105 meters, muddy ground. In a 30 minutes' haul with young-fish trawl without iron chain 1 young eel of 68 mm. was caught.

The Kattegat.

St. 364. April 4th, 1905. Between Anholt and Læsø 57°3′ N. 11°31′ E. Depth 9 meters. Gear: Young-fish trawl with iron chain on ground rope. In a haul, which lasted only 1 minute, 1 elver of 73 mm. was caught.

In this haul the trawl took up some sand. In another haul in the same place, of a duration of 15 minutes, *Fucus, Furcellaria, Corallina* etc. were brought forth, but no sand. In this haul no young eels were caught.

As the young elvers in the sea partly live a pelagic life they may often be transported far off by the currents. This may to a certain degree account for the fact, that there are often very great distances from the regions, where the eel larvae live, to the coasts where the young elvers occur (e. g. from the Atlantic to the coasts of the Baltic).

The external appearance of the young post-larval eel.

The young eels caught from the "Thor" in the sea have the same appearance as the elvers in the fresh water in their very first stage. They are glassy and transparent, and the pigmentation has just begun on the tip of the tail and, in most specimens, on the head. When they come into fresh water in spring various changes take place in their appearance. A young elver, which has been in a rivulet for a few weeks, differs from a colourless elver among others in the following respects:

1) The pigmentation has proceeded over a great part of the body.
2) The total length is less (see below p. 5—6).
3) The body heigth is less.
4) The pectorals are more narrow and pointed,
5) The lower jaw is less projecting.

The rate of growth of the young eel.

That the young colourless eel at least is one year old when it comes to our coasts in spring is almost beyond doubt. In this GRASSI is undoubtedly right. The silver eels migrate to the sea in autumn, *Leptocephalus brevirostris* has been found in the Atlantic in May by SCHMIDT and in August by HOLT (by GRASSI in the Mediterranean from February to September), and the elvers must appear later on. As shown by GRASSI *Leptocephalus brevirostris* and the hemi-larval stages of the eel are of a more considerable length than the completely metamorphosed young eels. The eel larvae which were caught by SCHMIDT and HOLT in the Atlantic in 1904 measured respectively 77 and 73 mm. The post-larval eels, which we have caught in the sea, have not yet reached the stage of their least length. It appears from a series of measurements, which are stated below (I—VI), that the young eels do not reach their smallest length till later in the year, when the pigmentation is far advanced.

I. March 24.—April 15. of 1905. The North Sea. 84 specimens caught from the "Thor" have an average length of 70·56 mm. The pigment is developed only on the tip of the tail and sometimes on the head. Measured by A. C. JOHANSEN.

II. April 26.—May 6. 1905. Brackish and nearly fresh water at Esbjerg. 228 specimens have an average length of 71·44 mm. The pigment is only developed on the tip of the tail and the head. Measured hy TARBEN TARBENSEN, a fisherman from the "Thor".

III. May 9. 1905. Rivulet at Maade brick-manufactory, Esbjerg. 90 elvers have an average length of 70·29 mm. In the majority of the specimens a slight pigmentation appear over the whole dorsal region. In a few specimens the pigment is restricted to the tip of the tail and the head. Measured by A. C. JOHANSEN.

IV. May 22. 1905. Same locality as III. 261 elvers have an average length of 69·15 mm. The dorsal region and the sides are now distinctly pigmented. Only in 6 specimens the pigment is restricted to the tip of the tail and the head. Measured by TARBEN TARBENSEN.

V. June 2.—3. 1905. Nymindegab on the west-coast of Jutland. Slight brackish water. 314 elvers have an average length of 67.92 mm. The specimens are distinctly pigmented. Measured by TARBEN TARBENSEN.

VI. June 14.—17. 1899. Rivulet at Ribe. West Jutland. 118 elvers have an average length of 65·70 mm. The specimens are distinctly pigmented. Measured by A. C. JOHANSEN.

Results of measurements of elvers from the localities mentioned above.

	I March 24—April 15.	II April 26—May 6.	III May 9.	IV May 22.	V June 2—3.	VI June 14—17.
58 mm.	"	"	"	"	"	1
59 —	"	"	"	"	"	1
60 —	"	"	"	"	"	2
61 —	"	"	"	"	"	8
62 —	"	"	"	2	3	10
63 —	"	1	"	3	5	10
64 —	1	"	"	3	24	17
65 —	4	6	3	18	42	13
66 —	1	8	8	23	30	8
67 —	9	10	5	21	44	12
68 —	7	12	9	33	37	7
69 —	8	21	11	43	39	12
70 —	14	37	17	44	37	7
71 —	8	26	7	21	18	4
72 —	11	28	11	21	18	4
73 —	7	20	6	9	6	1
74 —	5	20	4	9	5	1
75 —	4	14	4	7	4	"
76 —	3	8	2	3	2	"
77 —	"	8	2	"	"	"
78 —	1	5	1	1	"	"
79 —	1	4	"	"	"	"

Results of measurements of elvers from the localities mentioned above, calculated at the rate of 100 specimens for each locality.

	I March 24—April 15.	II April 26—May 6.	III May 9.	IV May 22.	V June 2—3.	VI June 14—17.
55—59 mm.	"	"	"	"	"	1.7
60—64 —	1.2	0.4	"	3.1	10.2	39.8
65—69 —	34.5	25.0	40	**52.9**	**61.1**	**44.1**
70—74 —	**53.6**	**57.5**	**50**	39.8	26.8	14.4
75—79 —	10.7	17.1	10	4.2	1.9	"

VII. June 29. Landskrona, the Sound. LILLJEBORG writes in "Sveriges og Norges Fiskar". III 1891, p. 383, that young eels, which were taken at the sea at Landskrona on June 29., had a length of 65 mm. On the same page is mentioned, that young eels, which were caught at the southern coast of Norway at the end of July or in August, had a length of 64 mm. We do not know, however, if LILLJEBORG's "length" means "average length", neither how many specimens he has measured.

VIII. July 30.—August 8. 1890. Holbæk Fjord, Sealand. Brackish water.

In "Beretning fra den danske biologiske Station I. 1891" C. G. JOHS. PETERSEN represents the measure-

ments of young eels as follows (the measurements are put down in Danish inches. 1 Danish inch = c. 2·6 cm.).

6	Inches	3	specimens	4	Inches	19	specimens
$5^3/_4$	—	4	—	$3^3/_4$	—	11	—
$5^1/_2$	—	10	—	$3^1/_2$	—	7	—
$5^1/_4$	—	11	—	$3^1/_4$	—	5	—
5	—	7	—	3	—	14	—
$4^3/_4$	—	11	—	$2^3/_4$	—	26	—
$4^1/_2$	—	31	—	$2^1/_2$	—	7	—
$4^1/_4$	—	27	—				

Dr. PETERSEN makes the following comments on the two size-groups: "These are surely owing to the fact that two such size-groups exist in nature, and having always found them very constant I cannot doubt, that they represent two annual series: the eels from $2^1/_2$—ca. 3 inches are the youngest known annual series, and those from 3—ca. 6 inches are a year older. A priori we might suppose, that these two groups were due to difference in size of the individuals of the two sexes, but I hardly think it likely that this should be the case, as eels of a length of 3 inches are so slightly developed sexually, that no trace of developing sexual organs appear, what Dr. JUNGERSEN has been kind enough to investigate on my request". The here cited remarks on the improbability of an essential size difference of the individuals of the two sexes in so early stages I can perfectly agree with. It should also be remembered, that in other fish-species where the older stages show a marked size-difference between the two sexes, for instance in such species as the plaice and the flounder, a difference worth mentioning does not appear during the first two or three years of their life.

The average size of the specimens of the youngest group from Holbæk is ca. 74 mm. The specimens of the next group, which no doubt are ca. 18 months older than the colourless elvers, have an average length of ca. 110 mm. Most specimens between $5^1/_4$ and 6 inches belong presumably to an older series.

IX. October 18. 1904. Rivulet at Frederikshavn. The Kattegat. 59 specimens, all pigmented.

6	cm	2	specimens	11	cm	6	specimens
7	—	15	—	12	—	3	—
8	—	19	—	13	—	„	—
9	—	7	—	14	—	2	—
10	—	4	—	15	—	1	—

The specimens from 6—ca. 9 à 10 cm. must be supposed to belong to the youngest annual series of metamorphosed eels. Their average length is a little below 8 cm.

X. March 28. 1905. Rivulet at Frederikshavn. The Kattegat. 102 fat pigmented eels, at least one year older than the colourless elver.

6·5	cm	1	specimens	10·5	cm	3	specimens
7	—	15	—	11	—	5	—
7·5	—	15	—	11·5	—	4	—
8	—	31	—	12	—	2	—
9	—	12	—	13	—	2	—
9·5	—	5	—	15·5	—	1	—
10	—	6	—				

The eels of a length of more than 9·5 cm. are much thicker than the smaller ones and belong presumably to an older series. It seems as if the individuals of the youngest series has not increased in length during the winter (see above).

XI. April 26.—May 22. 1905. Rivulets at Esbjerg. 181 young pigmented eels, at least one year older than the colourless elver. These are easily distinguished from the young elvers by their thickness and pigmentation. The specimens of more than ca. 94 mm. are much thicker than the smaller ones and belong presumably to an older series.

66 mm.....	2 specim.		82 mm.....	2 specim.		100 mm.....	2 specim.	
67 —	„	—	84 —	9	—	101 —	3	—
68 —	3	—	85 —	11	—	102 —	1	—
69 —	2	—	86 —	10	—	103 —	2	—
70 —	3	—	87 —	7	—	104 —	1	—
71 —	2	—	88 —	9	—	105 —	2	—
72 —	6	—	89 —	3	—	106 —	„	—
73 —	4	—	90 —	6	—	107 —	1	—
74 —	5	—	91 —	3	—	108 —	3	—
75 —	7	—	92 —	1	—	109 —	„	—
76 —	8	—	93 —	„	—	110 —	2	—
77 —	7	—	94 —	1	—	111 —	2	—
78 —	8	—	95 —	3	—	112 —	„	—
79 —	7	—	96 —	„	—	113 —	„	—
80 —	10	—	97 —	3	—	114 —	„	—
81 —	8	—	98 —	2	—	115 —	„	—
82 —	8	—	99 —	2	—	116 —	„	—

It appears from the before stated facts that the young colourless elvers, which appear in our seas and at our coasts in spring (March, April), have an average length of 70—72 mm. In the early summer (June) the great majority has become strongly pigmented, and the average length is now reduced to ca. 65—68 mm. Later in summer the increase in length begins again, and during the autumn the individuals reach an average size of about 80 mm. In the lapse of the winter the length does not seem to increase, and the young eels, which are ca. one year older than the colourless elvers, are still hardly 1 cm. longer than those.

In connection with the communication set forth here with regard to the reduction in size of the young eels I shall call attention to the fact that I have examined the intestinal canal of more than 30 specimens of colourless elvers without finding trace of food in any of them.

The enemies of the young eel.

The young eel has undoubtedly many enemies in the sea. At one of the "Thor"s' trawling stations in the Skagerak (St. 349. March 20—22. 1905. 57°42′ N. 10°23′ E. Depth 17 meters) some young eels were found in the stomach of *Gadus callarias* and *Gadus virens*. Among 85 specimens of the first-named species 6 had each one elver in their stomach, and among 4 specimens of the latter species 1 had swallowed an elver. P. Willumsen communicates in "Dansk Fiskeriforenings Medlemsblad" 1892 p. 15, that in the Sound it has frequently occurred in the winter that the cod has coughed up young eels of a lenght of 2—3 inches. Sometimes, he says, every cod has swallowed some of them. Several other accounts stating that young eels have served as food for the cod are at hand.

Summary:

a) The young postlarval eels in the sea are pelagic at night and keep in day time on the bottom. They have been caught on many of the "Thor"s stations, often far from the shore, in the Kattegat, the Skagerak, and the North Sea. Dr. PETERSEN has also noticed their pelagic habit at night in the Belt Sea (p. 3—4).

b) When the "colourless" elvers come into our seas and appear at our coasts in spring, the pigmentation has just begun on the tip of the tail and usually on the head. In this stage the transformation is not yet quite completed. At the same time as the pigmentation proceeds, the body height and the total length become less, the pectorals more narrow and pointed etc. (p. 5).

c) The "colourless" elvers, which appear in our seas and invade our rivulets in spring (March—April), have an average length of 70—72 mm. In June the great majority of the specimens have become strongly pigmented, and the average length is now reduced to ca. 65—68 mm. Later in summer the increase in length begins again, but the growth is so very slow, that the average-size of the specimens next spring is only ca. 80 mm. (p. 5—8).

d) At one of the "Thor"s trawling stations in the Skagerak young elvers were found in the stomach of *Gadus callarias* and *Gadus virens* (p. 8).

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